

Appl. No. 10/607,349
 Reply to Final Office Action of 09/21/2004

Patent/Docket No. 32173.2
 Customer No. 000027683



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
 Bor-Wen Chan, et al.

Serial No.: 10/728,995

Filed: December 5, 2003

For: MICROELECTRONIC DEVICE
 HAVING DISPOSABLE SPACER

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Group Art Unit: 2811

Examiner: HU, SHOUXIANG

Confirmation No.: 9115

Mail Stop AMENDMENT

Commissioner of Patents
 P. O. Box 1450
 Alexandria, VA 22313-1450

DECLARATION UNDER 37 C.F.R. § 1.131

I, Han-Jan Tao, declare and say that:

1. I am one of the three sole inventors of the subject matter disclosed and claimed in the above-identified application.

2. At all times set forth herein, I was an employee of Taiwan Semiconductor Manufacturing Co., Ltd., the assignee of the above identified application (hereinafter referred to as "TSMC"), in Taiwan.

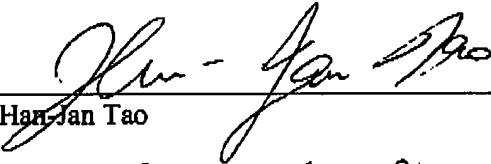
3. The invention claimed in the above-identified application was reduced to practice prior to February 12, 2003, the filing date of U.S. Patent App. Pub. No. 2004/0157457, as evidenced by the dated electron microscope images included in the PowerPoint presentation entitled "all-in-one disposable spacer" which was attached to the corresponding TSMC Invention Disclosure form that I approved before February 12, 2003. Redacted copies of the TSMC Invention Disclosure form and PowerPoint presentation are attached.

4. All of the activities described above occurred in Taiwan.

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I declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.



Han-Jan Tao
Date: 2005. 6. 28

EMP. NO.	FULL NAME(S) OF INVENTOR(S)		DEPT.	DEPT. CODE	TEL. NO.	E-Mail	SECURITY B TSMC-RESTRICTED
	ENGLISH Ex: Da-Tung Lee	CHINESE E Ex: 李大同					FOR USE BY PATENT AFFAIRS DEPARTMENT
014973	Bor-Wen Chan	詹博文	ADETC H	2332	712-58 17	BWCHAN@TSMC.COM.TW	DISCLOSURE NO.: TSMC0 [REDACTED] 399
014978	Yu-I Wang	王祐藝	ADETC H	2332	712-52 23	YUI_WANG@TSMC.COM.TW	
005963	Han-Jan Tao	陶宏遠	ADETC H	2332	712-53 04	HJTAO@tsmc.com.tw	RECEIVED DATE: (TIME STAMP)
							<div style="border: 1px solid black; padding: 5px;"> Intellectual Property [REDACTED] Mandy Liu </div>

- **TITLE OF INVENTION -- (ENGLISH ONLY)**
ENGLISH --ALL-IN-ONE DISPOSABLE SPACER
- **BACKGROUND INFORMATION -- CURRENT PRACTICE AND DISADVANTAGES (ENGLISH ONLY)**
The SIN, SiO₂ are the most popular for disposable material.
The disadvantages of SIN and SiO₂ are list as:
1.It is hard to remove them by wet.
2.Dry process will damage the underlayer.
3.Long cycle time, it needs deposit and etch to form spacer.
- **MAIN POINTS OF CLAIM (PLEASE LIST ITEM BY ITEM; 利用何種方法/手段達到目的) (ENGLISH ONLY)**
1. A method of fabricating a disposable spacer by all-in-one recipe in etcher, ther steps of:
Use C,H,F composite and Cl₂,Br base chemistry under <20W bias power condition
deposit polymer on first gate structure.
Change to O₂ base chemistry and with 10~200W bias power to control the anisotropic etch to get the spacer in the gate sidewall.
After previous steps, the disposable spacer can be gotten by all-in-one recipe.

2.The method as recited in claim 1, wherein the C,H,F composite chemistry are CF₄, CHF₃,CH₂F₂, CH₃F. The flow rate is in the range of 10~200sccm.

3.The method as recited in claim 1, wherein the Ar, He, Cl₂, HBr could add to O₂ plasma for spacer etch chemistry.

4.The method as recited in claim 1, wherein the spacer material is a polymer.

5. The method as recited in claim 2, wherein the polymer has a thickness between 100 and 1000 Angstroms.
- **PROBLEM SOLVED OR IMPROVEMENTS OBTAINED BY THIS INVENTION (PLEASE LIST ITEM BY**

ITEM) (ENGLISH ONLY)

1. Simplify the process flow.
2. Low cost.
3. The bias power can improve the step coverage.
4. Easily to remove by O2 plasma, less substrate and oxide layer damage.

• KEYWORD SEARCH FOR PATENT/LITERATURES (ENGLISH ONLY)

all-in-one, disposable, spacer

THIS INVENTION DISCLOSURE IS YOUR FIRST TIME TO BE SUBMITTED

● Yes

○ No

IF NO, RESUBMITTED. THE PRIOR INVENTION DISCLOSURE NUMBER IS__

• DETAIL DESCRIPTION OF INVENTION (ENGLISH ONLY)

1. Fig. 1 shows the film scheme
2. Fig. 2 shows the polymer deposition, the exp. data also show in below
3. Fig. 3 shows spacer etch formation by all-in-one step
4. Fig. 4 shows S/D implantation
5. Fig. 5 shows the polymer remove by O2 plasma, it can avoid the underlayer loss

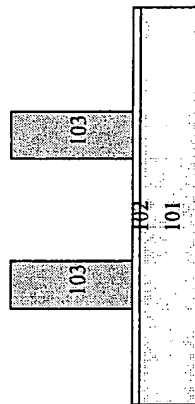
ATTACHMENTS: all-in-one spacer.ppt

WITNESS: THE TWO WITNESSES WHOSE SIGNATURES APPEAR BELOW HAVE <u>READ</u> AND <u>UNDERSTOOD</u> THIS ENTIRE INVENTION DISCLOSURE.	SIGNATURE OF WITNESS	DATE	SIGNATURE OF WITNESS	DATE
	邵頌光		郭美如	
DISCLOSURE SUBMITTED BY				
INVENTORS' EMPNO	INVENTORS' NAME	INVENTOR'S SIGNATURE	DATE	
	詹博文	詹博文		
	王祐藝	王祐藝		
	陶宏遠	陶宏遠		

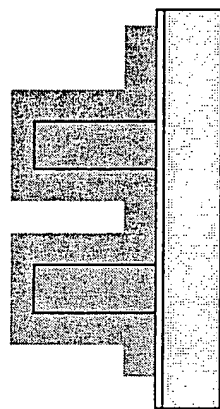
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Prior disposable spacer approach

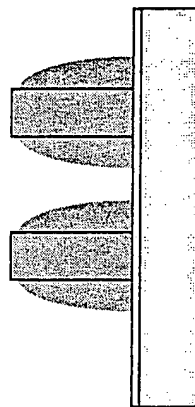
1. Film stack: gate pattern



2. SIN deposition



3. Spacer pattern



Film stack

101:Sub Si

102:gate oxide

103:polysilicon

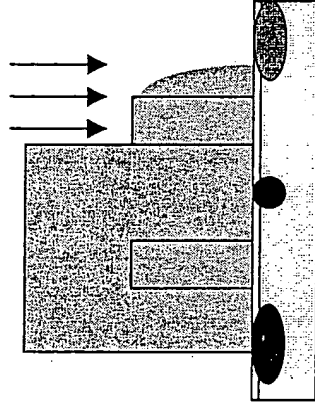
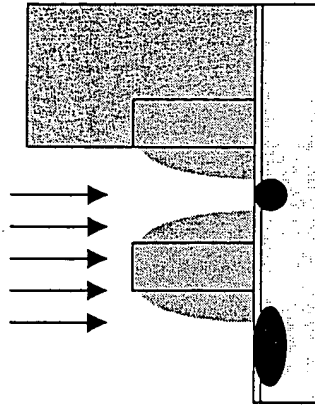
104:hardmask(SION,SIN)

105:PR mask

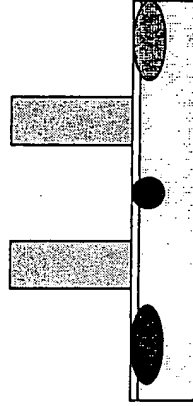
all-in-one disposable spacer

Prior disposable spacer approach

4. S/D implant



5. Spacer remove



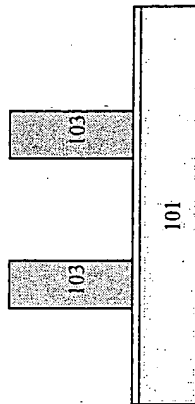
Comment:

1. wet can't remove the SIN spacer, due to SIN formed harden layer after implant.
2. dry etch remove will suffer the underlayer damage.

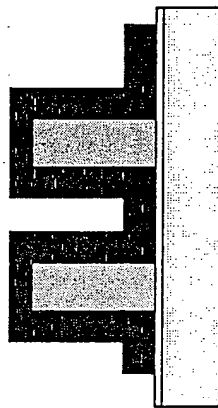
all-in-one disposable spacer

All-in-one disposable spacer approach

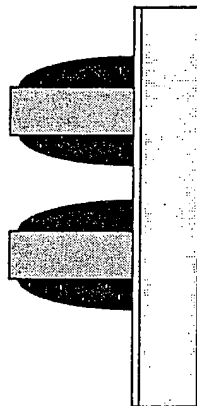
1. Film stack: gate pattern



2. Polymer deposition



3. Spacer pattern



Film stack

101:Sub Si

102:gate oxide

103:polysilicon

104:hardmask(SION,SIN)

105:PR mask

Comment:

use CH₂F₂, HBr deposit

polymer on the sidewall

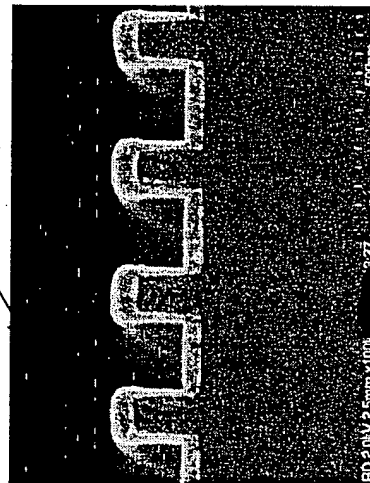
of poly line

Comment:

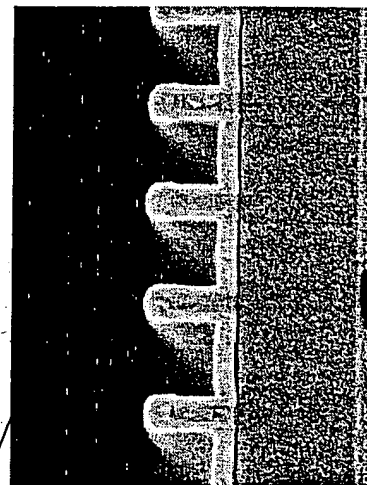
use O₂ base plasma with

bias power to form side-

wall spacer.

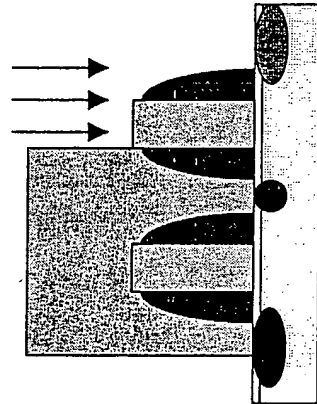
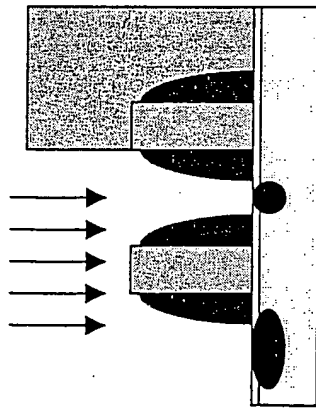


all-in-one disposable spacer

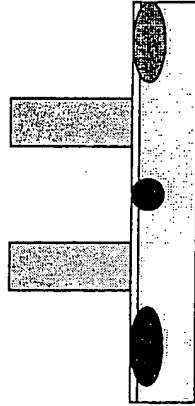


All-in-one disposable spacer approach

4. S/D implant



5. Spacer remove



Comment:

O₂ plasma can remove the polymer spacer and don't damage the underlayer.

Summary the advantage of all-in-one disposable spacer approach:

1. Simplify the process flow.
2. Low cost.
3. The bias power can improve the step coverage.
4. Easily to remove by O₂ plasma, less substrate and oxide layer damage.

all-in-one disposable spacer